$$\frac{1}{12e^{-6x}}\left(\frac{4dy}{dx}+\frac{d^2y}{dx^2}\right)=B \quad \cdots (5)$$

put eqn (5) in eqn (2)

$$\frac{d^2y}{dx^2}=16Ae^{-4x}+36e^{-6x}\left[\frac{1}{12e^{-6x}}\left(\frac{4dy}{dx}+\frac{d^2y}{dx^2}\right)\right]$$

$$\frac{d^2y}{dx^2}=16Ae^{-4x}+3\left(\frac{4dy}{dx}+\frac{d^2y}{dx^2}\right)$$

$$\frac{d^2y}{dx^2}=16Ae^{-4x}+12\frac{dy}{dx}+3\frac{d^2y}{dx^2}$$

$$16Ae^{-4}=-1\left(\frac{2d^2y}{dx^2}+12\frac{dy}{dx}\right)$$

$$16Ae^{-4}=-2\left(\frac{d^2y}{dx^2}+6\frac{dy}{dx}\right)$$

$$8Ae^{-4}=-\left(\frac{d^2y}{dx^2}+6\frac{dy}{dx}\right)$$

$$A=-\left(\frac{d^2y}{dx^2}+6\frac{dy}{dx}\right)\cdot\frac{1}{8e^{-4}}$$

then put A & B in y

$$y=Ae^{-4x}+Be^{-6x}$$

$$=-\left(\frac{d^2y}{dx^2}+6\frac{dy}{dx}\right)\cdot\frac{1}{8e^{-4}}\cdot e^{-4x}+\left(\frac{d^2y}{dx^2}+4\frac{dy}{dx}\right)\cdot\frac{1}{12e^{-6x}}\cdot e^{-6x}$$

$$y=\left(\frac{-d^2y}{dx^2}-6\frac{dy}{dx}\right)\cdot\frac{1}{8}+\left(\frac{d^2y}{dx^2}+4\frac{dy}{dx}\right)\frac{1}{12}$$

$$y=\frac{3\left(\frac{-d^2y}{dx^2}-6\frac{dy}{dx}\right)+2\left(\frac{d^2y}{dx^2}+4\frac{dy}{dx}\right)}{24}$$

$$24y=-3\frac{d^2y}{dx^2}-18\frac{dy}{dx}+2\frac{d^2y}{dx^2}+8\frac{dy}{dx}$$

$$24y=\frac{-d^2y}{dx^2}-10\frac{dy}{dx}$$

$$\frac{d^2y}{dx^2}+10\frac{dy}{dx}+24y=0 \quad \cdots \text{2nd order eqn.}$$

OYUGBO EBERUBE V

17/ENG06/072

MECHANICAL ENGINEERING

ENR 282

ASSIGNMENT 1

a) Define differential equation and give two examples

b) An express has been obtained for engineering system to be as given in equation (1)

e) $y = Ae^{-4x} + Be^{-6x}$

i) what is the order of the differential equation that can be formed from the equation?

ii) Give a reason for your answer

iii) Form a differential equation from the equation

Solution:

a) Differential equation is the relationship between a dependent variable and one or more derivative by dependent variable with respect to the independent variable

e.g. $x\frac{dy}{dx} = 3x^2 + 2$

(ii) $6\frac{dy}{dx} = \frac{d^2y}{dx^2} + x$

b) i) Second order differential equation

ii) This is because it has two arbitrary constants A & B

iii) $y = Ae^{-4x} + Be^{-6x}$

$\frac{dy}{dx} = -4Ae^{-4x} - 6Be^{-6x}$ ... ①

$\frac{d^2y}{dx^2} = 16Ae^{-4x} + 36Be^{-6x}$ ... ②

Then multiply eqn ① by 4

$4\frac{dy}{dx} = -16Ae^{-4x} - 24Be^{-6x}$ ... ③

then add eqn ② & ③

$4\frac{dy}{dx} + \frac{d^2y}{dx^2} = 12Be^{-6x}$